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12. Tabular Statement furnished by Dr. Max C. Starkloff, Health Commissioner of St. Louis, 1900.
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OBSERVATIONS ON THE CHARACTER OF THE CELLS IN THE EXUDATION IN ACUTE INTERSTITIAL NEPHRITIS, WITH SPECIAL REFERENCE TO THE PRESENCE OF CELLS WITH EOSINOPHILIC GRANULATIONS.

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In 1897 Councilman[1] reported nine cases of acute interstitial nephritis, of which four occurred in individuals dead from scarlet fever, one from diphtheria and scarlet fever, two from diphtheria, one after criminal abortion, and in one case the initial lesion was unknown.

Councilman described the initial lesion as being an accumulation in the interstitial tissue of the organ of cells in every way similar to those seen in hyperplasia of connective tissue. Some of the cells he regarded as leucocytes, but they seemed to be derived in large part from the endothelium of the small veins and capillaries, but not from that of the arteries.

The cells of the connective tissue of the glomerular capsules were also said to take part in the process. The interstitial cell increase was both general and focal. A variable amount of degeneration of the renal epithelium was noted; but that was not regarded as the primary lesion, and was attributed in part at least to the pressure exerted by the cells in the interstitial tissue.

Cultures were made in five of the cases, and in all there was a general infection with the streptococcus, and in one case the diphtheria bacillus was also found. Œdema was absent and there were no symptoms pointing to disease of the kidneys.

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[1] The American Journal of the Medical Sciences, vol. civ.

In a second and more elaborate article on the subject in 1898, Councilman[1] states that in two and a half years he found 42 cases of acute infectious diseases in which acute interstitial nephritis was present. Of these cases 24 were diphtheria, 5 scarlet fever, 5 diphtheria and scarlet fever, 2 diphtheria and measles, 1 measles and whooping-cough, 1 empyema with subsequent diphtheria, 1 lobar pneumonia and pericarditis, 1 epidemic cerebro-spinal meningitis, 1 lobar pneumonia, and 1 acute endocarditis following abortion. Presumably the later series includes the nine cases mentioned in his first article. Bacteriological investigation of the kidneys resulted as follows:

In the 29 cases of pure diphtheria the kidneys were sterile in 6, the colon bacillus occurred in 11, the streptococcus pyogenes in 5, the B. diphtheriæ in 8, B. fœtidus in 1. In 5 cases of pure scarlet fever B. coli was found in 2, the streptococcus in 3, and the staphylococcus aureus in 1. Of 8 cases of mixed diphtheria and scarlatina and measles 2 were sterile, the streptococcus occurred in 3, and B. coli in 3. In the remaining 6 cases B. coli occurred in 3, the staphylococcus aureus in 2, the streptococcus in 4, the pneumococcus in 1, and 1 case was sterile. Bacteria were not found in hardened sections of the kidneys.

As the result of these observations Councilman concludes that " we cannot lay any weight on the presence of bacteria in the kidney as a constant factor in the acute interstitial lesion."

Beside the forty-two cases associated with general diseases, Councilman found three others in which the interstitial process was due to the local action of bacteria.

In the first case—one of ascending ureteritis and pyelonephritis—cultures gave B. coli and streptococci. About the necrotic areas there was an " intense infiltration of the tissues with plasma cells." These cells were also present in the surrounding vessels.

In the second case there were multiple small, hæmatogenous renal abscesses, secondary to carbuncle of the neck and thrombosis of the lateral sinuses, with the staphylococcus aureus in pure culture. In the typical abscesses there were micrococci, a mass of pus cells, and nuclear detritus. Outside of the abscesses there were a number of large epithelioid cells, many of which contained micrococci and other cells, and outside of this cell layer there was an intense infiltration with plasma cells, which were also present in the bloodvessels.

In the third case—one of scarlatina with abscess beneath the scalp and general infection with the staphylococcus aureus—there was general interstitial nephritis and small abscesses with surrounding plasma-cell infiltration.

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[1] Journal of Experimental Medicine, 1898, vol. iii., Nos. 4 and 5.

In this article Councilman gives an extensive review of the literature of acute interstitial nephritis. It is neither profitable nor advisable to repeat this in the present paper, but I will refer the reader to Councilman's article. He shows that acute interstitial nephritis was first described in a case of scarlatina by Biermer in 1860. Since then it has been described by a number of authors as occurring chiefly in scarlatina, diphtheria, typhoid fever, and acute infections. Some authors regard it as the most characteristic lesion of scarlatinal nephritis.

A review of the articles quoted by Councilman shows that the cells in the interstitial process have been regarded as lymphocytes by Biermer, Wagner (who describes the process as "lymphomatous nephritis"), Klebs, Coats, and Klein. Litten and Von Kahlden called them leucocytes. They are referred to as "round cells," or "small round-cell infiltration," by Weigert, Waller, Dunin, Fischl, Friedlander, Neuwerck, Langhans, Litten, Oertel, Sörensen, Baginsky and Stamm, Bernard and Felsenthal, and Rosenstein. Kelsch regards them as embryonic in character.

Coats and Neuwerck believe that they are derived from the bloodvessels, while Crooke states that they are derived from the blood as well as from proliferation of the endothelium of the capillaries. Orth states that the interstitial cells are not similar to leucocytes, and have a round, vesicular nucleus. He thinks they are derived from connective-tissue cells, but says their relation to the small veins speaks in favor of emigration.

Councilman defines acute interstitial nephritis as "an acute inflammation of the kidney, characterized by cellular and fluid exudation into the interstitial tissue, accompanied by but not dependent on degeneration of the epithelium; the exudation is not purulent in character, and the lesions may be both diffuse and focal."

The foci are found chiefly in three places—the boundary zone of the pyramids, the subcapsular region of the cortex, and around the glomeruli. In some cases the bloodvessels of the boundary zone contain numbers of lymphoid cells and plasma cells. Councilman gives a clear description of the cells in the interstitial tissue and identifies them with Unna's plasma cells, of which he gives an historical sketch. He agrees with Marschalkó, that these cells are derived from lymphocytes. He states that the plasma cells in the interstitial tissue come partly from the bloodvessels, through the walls of which their passage can be traced, and partly from mitotic division of the emigrated cells. The latter may emigrate, either as lymphoid cells or as plasma cells. Variable numbers of both of these varieties of cells are found in the bloodvessels. The interstitial cells lie in larger and smaller groups between but never in the tubules, upon which they often exert considerable pressure. Councilman found nuclear figures in plasma cells in the bloodvessels as well as in the tissues, where they were often very numerous. In marked cases other kinds of cells were found in the interstitial tissue. Of these the most common were lymphoid cells, the transition of which into plasma cells could often be traced. "Polynuclear leucocytes" (presumably neutrophilic, but whether neutrophilic or eosinophilic is not stated) were "usually present in variable numbers, depending upon the degree of degeneration of the epithelium."

In addition to these varieties, in a few instances, large phagocytic cells of the epithelioid type were seen. Councilman believes these cells to be derived from the tissue cells. They may contain red blood-cells, leucocytes, and plasma cells. The epithelium showed cloudy swelling and fatty degeneration in variable degree, and in some cells vacuoles and globular hyaline masses were found. Some tubules were markedly dilated and some entirely destroyed. There were usually no glomerular changes, although acute interstitial nephritis was sometimes met with as a complication of typical glomerulo-nephritis. Leucocytes were sometimes found in the tubules.

SUMMARY. The cells in acute interstitial nephritis have been described by various authors as "lymphoid cells," "small round-cell infiltration," "leucocytes," and have been thought to have their origin in (1) the bloodvessels (emigration), (2) proliferation of the vascular endothelium, (3) from the fixed connective-tissue cells of the part. Councilman, the latest and most exhaustive writer on the subject, finds the most numerous cells to be the plasma cells, but finds that lymphoid cell (lymphocytes) and polynuclear leucocytes are also present in variable numbers.

These cells are all derived from the bloodvessels, whence they emigrate into the interstitial tissue. He traces the origin of the plasma cells from lymphocytes, and for the first time demonstrates their active mitotic division in the tissues and bloodvessels. He also points out their highly developed amœboid activity. Councilman further describes the presence of large epithelioid phagocytic cells.

REPORT OF CASES. During the last two years, in the routine examination of my autopsy material, I have met with the following cases of typical acute interstitial nephritis:

CASE I. *Summary: General streptococcus bacteriæmia after abortion; marked acute interstitial nephritis, with large numbers of plasma cells; polymorphonuclear eosinophiles and a few lymphocytes in the exudation.*—M. A., female, aged thirty-five years, entered Lakeside Hospital, December 7, 1898, and died the next day. There was a history of recent abortion. There were no symptoms pointing to the kidneys.

Autopsy, Sixteen Hours after Death. Anatomical diagnosis: Ulcerative stomatitis, acute pharyngitis, laryngitis, bronchitis, and bronchopneumonia, congestion and œdema of the lungs; acute interstitial nephritis, fatty degeneration and cloudy swelling, with bile pigmentation of the liver and kidneys. Acute splenic tumor, syphilitic cirrhosis of the liver. Retained placenta after abortion. Streptococcus bacteriæmia. Infection of the uterus with the streptococcus and B. mucosus capsulatus. Gaseous emphysema of the gall-bladder, due to B. aërogenes capsulatus.

The kidneys were enlarged, the right weighing 370 and the left 330 grammes. The capsules were readily removed; the surfaces were smooth, but deeply stained with bile-pigment. On section, both organs presented the same appearances; they were markedly œdematous and congested, and a large amount of serum and blood escaped on section. The cortices were thickened, averaging 1 cm. in thickness, and denser than ordinary. The glomeruli were inconspicuous. The cut surface was pale and opaque. The medullary as well as the cortical portion was deeply stained with bile-pigment. The pelves, ureters, and vessels were normal. The adrenals were normal.

The description of the other organs is without present interest.

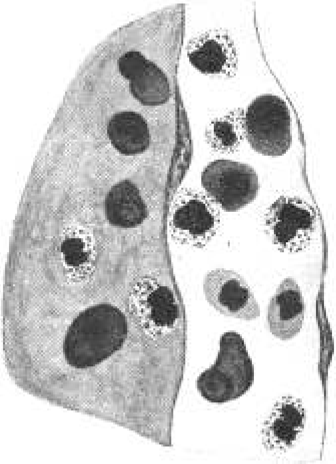
Cover-slips from the uterus and lungs showed streptococci in short chains. Aërobic agar plate cultures from the lungs, pleura, spleen, and kidneys showed the streptococcus pyogenes in pure culture; those from the uterus showed the streptococcus and B. mucosus capsulatus. Cover-slips and animal experiments from the gaseous emphysema about the gall-bladder showed B. aërogenes capsulatus.

Histological Examination of the Kidneys. Portions of the various organs were hardened in Zenker's fluid, embedded in paraffin, sectioned, and stained in hæmatoxylin and eosin and in eosin and Unna's alkaline methylene-blue.

Kidneys. Glomeruli: The capillaries are dilated and contain large numbers of red blood-cells and occasional polymorphonuclear eosinophiles and plasma cells. No changes can be made out in the capillary walls. The capsular epithelium of the glomeruli is swollen, granular, and occasionally desquamated. Bowman's capsules are unchanged. The epithelial cells of the convoluted tubules are swollen and granular and desquamated in many places. Some tubules contain coarsely granular material, which stains intensely with eosin. In the convoluted tubules a few of the epithelial cells contain nuclear figures. Some tubules contain many cells.

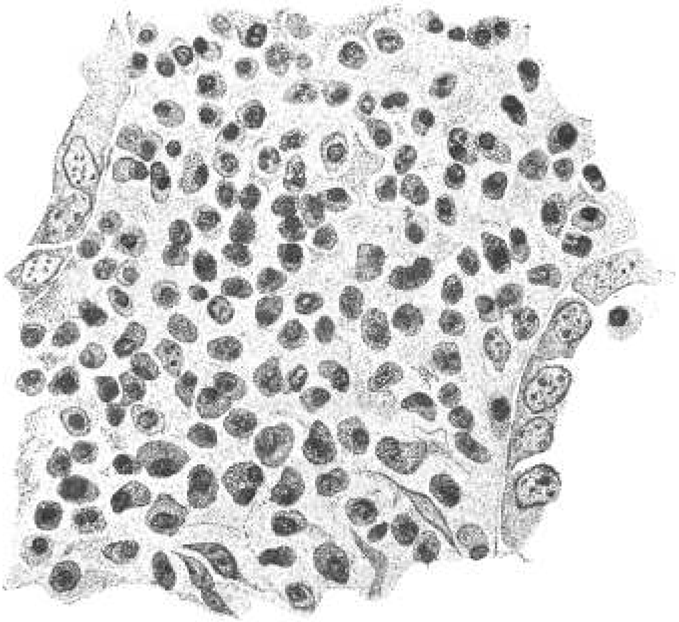
There are everywhere signs of marked œdema of the interstitial tissue. The most marked changes are seen in the interstitial tissue between the tubules and along the course of some of the arteries and veins. About many of these, especially the interlobular vessels near the medulla and in the intermediate zone, the adventitia coat and the perivascular fibrous tissue are infiltrated with large numbers of cells—plasma cells, lymphocytes, large mononuclear leucocytes, and polymorphonuclear and mononuclear eosinophiles (Fig. 1). The proportion between the various cells varies greatly, but in general the plasma cell is the most numerous cell, and often there are large numbers of eosinophiles. In some places these latter form at least one-third of the cells present and in others they are the most numerous cells in the exudation. The same cells are often seen in the media of small arteries and veins, the lumina of which commonly show larger and smaller numbers of the same cells. Plasma cells and eosinophiles are often present in large numbers in the intertubular capillaries, and sometimes also in the glomerular capillaries. No endarteritis is to be found. The bloodvessels in general contain variable numbers of plasma cells and eosinophiles. Scattered throughout the cortical portion of the organs, often in association with the arteries and veins, as above described, but often at a distance from

FIG. 1.



Capillary and surrounding tissue, showing plasma cells, large mononuclear leucocytes, and eosinophiles. The last named are distinguished by their granular protoplasm.

FIG. 2.

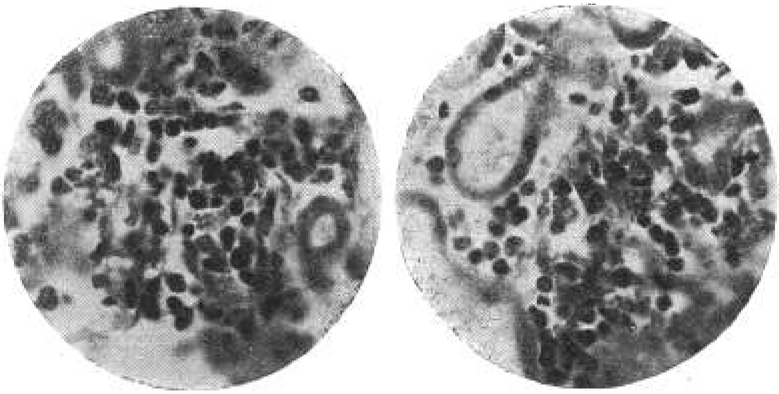


Intertubular exudation of plasma cells, mononuclear leucocytes, and eosinophiles. The cells with coarsely granular protoplasm are eosinophiles.

these, there are a large number of areas of intertubular cellular infiltration. Here the tubules are compressed to a greater or lesser degree, and are often entirely obliterated. These areas are very numerous in the peripheral portion of the cortex, but are most numerous near the medulla. In general, the cells of these areas are of three kinds—plasma cells, lymphocytes, and eosinophiles—while large mononuclear leucocytes are sometimes seen (Figs. 2 and 3).

The plasma cells are sometimes round, sometimes oval or long oval, and often very much elongated. Judging from their shape, many had evidently been actively motile. Their nuclei are distinctive, with well-marked rim, from which often projections extend into the interior of the nucleus, where in many cells densely staining chromatin masses were seen. In most cells the nuclei are placed eccentrically. The cytoplasm usually, but not invariably, stains a bluish hue with the methylene-blue. In some places transitional forms between lymphocytes and plasma cells are seen in both the bloodvessels and the tissues. In some cells there are two, and in a few even three, nuclei. Mitotic figures are often seen in the plasma cells.

FIG. 3.



Photomicrographs showing intertubular exudate.

The eosinophiles of the bloodvessels as well as ot the tissues are almost invariably of the polymorphonuclear type, with coarse, eosinophilic granulations. Comparatively few mononuclear forms are present. No transitional forms between mononuclear leucocytes, lymphocytes, or plasma cells are found. The eosinophiles in the kidneys in this case were evidently brought there by the blood and were not formed locally. The cells in the areas of the infiltration were evidently derived from the bloodvessels—a true exudation. No bacteria were found in sections of the kidney.

CASE II. *Summary: Unsuspected acute interstitial nephritis, with plasma cells and mononuclear and polymorphonuclear eosinophilic leucocytes in the intertubular exudation; tuberculosis of the bronchial glands, with eosinophiles in the tubercular tissue; prolapsus uteri; abortion; vaginal hysterectomy.*—Mrs. E. C., white, aged thirty years, was admitted to Lakeside Hospital, service of Dr. Hunter Robb, December 10, 1898, exhibiting labor pains. She had had measles and malaria some time before. She had had prolapsus uteri for some time. She has one child, aged five years; aborted at the fifth month about two years ago, and had a full-term child fourteen months ago. Her urine examined on the day of admission was straw-colored, with specific gravity 1018, and free from albumin and sugar. In the slight sediment there were amorphous urates, a few epithelial cells, and some leucocytes. A blood-count made December 19th showed 3,950,000 red blood-cells and 24,000 leucocytes per c.mm. A differential count of the latter was not made.

Operations. December 19th, curettement and irrigation of the uterus to remove abortion remnants. December 28th, vaginal hysterectomy with removal of the right ovary and tube. Convalescence was uninterrupted until her sudden death, eighteen days after the last operation, and the day before the one set for her discharge from the hospital.

Anatomical diagnosis: Hypoplasia of the cerebellum, cyst of the pia arachnoid at the base of the brain. Acute interstitial nephritis; small stitch abscess of pedicle.

Cover-slip preparations and plate cultures from the various organs, including the kidneys, were negative. From a small stitch abscess in the pedicle a few colonies of the staphylococcus aureus grew.

Portions of the organ were hardened in Zenker's and in Orth's fluids and in alcohol. Sections of the kidneys were embedded in paraffin and stained in hæmatoxylin and eosin, and in eosin and in Unna's alkaline methylene-blue. The bronchial glands and the kidneys being the only organs of present interest, a description of the macroscopical and microscopical appearances of the other organs will be omitted.

Kidneys. The right kidney weighed 175 grammes, and measured 11 x 6 x 4 cm.; the left weighed 145 grammes, and measured 10 x 6 x 4 cm., otherwise they were exactly alike.

The capsules were readily removed. The surfaces were smooth and showed numerous irregular, small, pale areas. On section, both organs were markedly congested, but not specially œdematous. In the cortex the glomeruli were inconspicuous. The cut surface was moderately glistening. Scattered through the cortices there were a large number of small, pale, white areas; in these places the consistency was somewhat increased. The medullæ were congested, otherwise normal. The pelves, ureters, arteries, and veins appeared normal.

Microscopical Appearances of the Kidneys. The capsules were somewhat thickened. The glomeruli were normal in appearance. The epithelial cells of the convoluted tubules were granular and in some places contained vacuoles. Scattered throughout the cortex, but best marked at the periphery and in the so-called intermedial zone, there were larger and smaller areas of cellular infiltration. These areas varied from a few to several micromillimetres in size. In general they were round or long and oval in outline. They often surrounded a glomerulus, the capillaries of which are dilated, sometimes thickened, and contained an increased number of cells, some of which were typical eosinophiles. The glomerular spaces were free from cellular or other exudation. There was no desquamation of the capsular epithelium. The cell accumulations were almost entirely intertubular, but in many places cells were grouped about the glomerular capsules. The tubules in these areas were often markedly compressed, and a few were dilated and contained cells similar to those found in the intertubular tissue. There was very little change to be made out in the tubular epithelium, even in the largest areas of cell infiltration. The plasma cell was the most numerous cell in these areas, but a large proportion of the cells were lymphocytes, and there were a considerable number of large mononuclear leucocytes. In some places there were many typical coarsely granular eosinophiles, some mononuclear, others polymorphonuclear. The capillaries in these areas were usually dilated, often markedly so. They contained large numbers of leucocytes, but few erythrocytes. The proportion between the various kinds of leucocytes was about the same as in the tissues. The plasma cells and eosinophiles often outnumbered the other cells in the dilated capillaries. In some places the capillaries distended by these cells compressed the tubules. Sometimes the perivascular spaces between the tubules and the distended capillaries were crowded with cells similar to those contained in the latter. No nuclear figures were seen in cells in the capillaries. Many of the small veins contain an increased number of leucocytes. The cells in the interstitial tissue evidently came from the bloodvessels. Here and there nuclear figures could be made out in the plasma cells in the intertubular tissue. The proportion of lymphocytes in the capillaries and in the interstitial tissue was greater in this case than in the other two. The adventitia coat and the perivascular tissue of some of the interlobular arteries showed infiltration with plasma cells, lymphocytes, and eosinophiles.

No transition of eosinophiles from plasma cells or mononuclear leucocytes could be traced in this case. The eosinophiles were nearly as numerous in the capillaries as in the interstitial tissue. They certainly were in large part, if not exclusively, brought to the part by the bloodvessels. These cells were very numerous in the interstitial exudation in this case; in some places from ten to fifteen could be counted in a single field of the oil-immersion lens. No eosinophiles could be found in sections of the uterus, ovaries, or tubes. The only other organs in the body in which these cells were found was in a tuberculous bronchial gland, in the lymph-channels and stroma, of which large numbers of eosinophiles were found.

No bacteria were found in the hardened sections of the kidneys.

CASE III. *Summary: Death from bronchopneumonia secondary to otitis media; unsuspected acute interstitial nephritis, with plasma cells, lymphocytes and eosinophiles in the exudation.*—A female child, aged six weeks, died at St. Anne's Hospital, service of Dr. Thomas, after a few days' illness with otitis media and bronchopneumonia. The body was sent to the laboratory for autopsy.

Anatomical diagnosis: Acute bronchopneumonia (slight) of both lungs; otitis media of the left side. Congestion of the lungs, liver, spleen, and brain. Fatty degeneration of the liver. Marked œdema of the kidneys, with acute interstitial nephritis.

Cultures from the lungs showed large numbers of streptococci in pure culture; from the left middle ear streptococci and B. mucosus capsulatus. Cultures from the other organs were negative.

The right kidney weighed 55 grammes, the left 65 grammes. They were of the same general appearance. The capsules were easily removed; the surfaces were smooth. On section, both organs were uniformly very pale, almost white in color. The consistency was soft, and there was extreme œdema. The cortices were swollen. The pelves, cortices, and ureters were normal. No focal changes were discerned on macroscopical examination.

The gross description of the other organs is without present interest.

Kidneys. Portions of the organ were hardened in Orth's fluid, cut in paraffin, stained in hæmatoxylin and eosin and in methylene-blue and eosin.

Glomeruli: The glomeruli for the most part filled the capsules, which were not thickened. The glomerular capillaries were often dilated and contained red blood-cells, large mononuclear leucocytes, lymphocytes, and often typical plasma cells. The epithelial cells covering the capillary walls and Bowman's capsule showed no special changes. In a few capsular spaces there were a few mononuclear leucocytes and plasma cells and some finely granular material.

Tubules: The epithelial cells of the convoluted tubules showed in places moderate cloudy swelling. Some of the tubules contained granular material. Here and there tubules, especially the straight tubules and the tubules of the pyramids, contained larger and smaller numbers of plasma cells, lymphocytes, large mononuclear leucocytes, and occasionally eosinophiles. In a few places there was desquamation of some tubal epithelial cells. A few renal epithelial cells showed nuclear figures and contained leucocytes. There were no focal areas of necrosis.

Interstitial tissue: The interstitial tissue of the cortex showed the most marked changes. Here the structures were often widely separated, evidently by œdema. Here and there large and small areas of cellular infiltration of the intertubular tissue were seen. These areas varied very much in number and extent in different sections; they were often most numerous in the superficial layer of the cortex; in other places they were numerous in the intermediate zone. In still other sections they were rather evenly distributed through the cortical substance. They were often found about glomeruli, which were, however, unchanged or, at most, were compressed. These areas of infiltration varied in shape; about the glomeruli they were usually somewhat crescentic in outline; when between tubules they were often elongated or oval; while about branches of the interlobular arteries they were either round or elliptical in shape. These areas varied very much in size, from a few cells to areas of 100 or 200 micromillimetres in diameter. These cells lay in the intertubular tissue, in the bloodvessels, and in the media and adventitia coats of arteries. By far the most common cell in the infiltration was the plasma cell. A few large mononuclear leucocytes and typical lymphocytes were seen.

There was a variable number of coarsely granular eosinophiles, both in the areas of cellular infiltration and in the capillaries. These cells usually had densely staining nuclei, which were often trilobate. In some the nucleus was similar to that of the typical plasma cell. One elongated cell with eosinophilic granulations had a plasma-cell nucleus at each end of the cell. Here and there pictures were seen which suggested that eosinophiles had developed from plasma cells, but it was apparent that most of the former had emigrated from the bloodvessels. In many cells with cytoplasm like that of plasma cells nuclear figures were seen. Many of the areas of interstitial infiltration were situated about small arteries, afferent and efferent vessels, as well as interlobular arteries. The same cells described in the intertubular exudation were found in the adventitia and perivascular spaces of the vessels.

The periarterial infiltration was a marked feature of the process.

In the medullary portion of kidneys the capillaries were congested, and here and there small areas of cellular infiltration were found. A few eosinophiles were found in the mesenteric glands, the thymus, and the stroma of the mucosa of the intestines.

In the above cases of interstitial nephritis, two occurring after abortion—in one instance with general streptococcus infection; in the other no micro-organisms being demonstrated, and in the third bronchopneumonia and otitis media of streptococcus origin—I have been able to confirm in every respect the observations of Councilman on the character and origin of the cells in the interstitial exudation. I have further met with a cell not hitherto described in renal exudates, namely, the eosinophilic leucocyte. This cell was very numerous in the interstitial exudation in two cases (I. and III.), and in one case (I.) in many places it was the most numerous cell present. In two cases the presence of this cell in the exudation appeared to be due solely to emigration from the bloodvessels, while in one case (III.), in addition to this, it was evidently also due to transition from plasma cells in the interstitial tissue.

I have also been able to confirm Councilman's observation of the presence of plasma cells in the bloodvessels and the mitosis of these cells. There can be no doubt that they possess amœboid activity to a high degree.

In addition to these cases of typical acute interstitial nephritis, the records contain three other cases of interest in this connection. The first case was one of chronic interstitial nephritis with marked connective tissue increase. Beside the small round cells (lymphocytes?) plasma cells and mononuclear and polymorphonuclear eosinophilic cells were found in considerable numbers in the areas of cellular infiltration.

The second case was one of hemorrhagic cystitis, prostatic abscess, pyelonephritis, chronic arterio-sclerotic nephritis, and gaseous emphysema of the kidneys and liver. Cultures from the kidneys showed the streptococcus, B. coli, and B. aërogenes capsulatus. Sections of the kidneys hardened in Zenker's fluid, cut in paraffin, and stained with eosin and methylene-blue showed, beside well-marked arterio-sclerotic nephritis, multiple abscesses and larger and smaller areas of cellular infiltration without tissue necrosis. In the abscesses there was always a central area of necrosis surrounded by polymorphonuclear leucocytes, plasma cells, and eosinophiles, the polymorphonuclear neutrophile being the most numerous cell. Many cells were found in the neighboring tubules as well as in the interstitial tissue. In these areas there were cocci, short, thin bacilli, and large numbers of long and short, stout bacilli, corresponding respectively to the streptococcus, B. coli, and B. aërogenes capsulatus obtained in cultures. Beside these areas of abscess formation, scattered throughout the sections, but most numerous in the deep cortical and medullary portions, there were larger and smaller areas of diffuse interstitial nephritis, with plasma cells, polymorphonuclear, neutrophilic and eosinophilic leucocytes. Similar cells were seen in the dilated vessels. These areas were free from tissue necrosis.

In the third case there were acute and chronic interstitial nephritis, with small abscesses and epithelioma of the bladder. Cultures from the genito-urinary as well as the other organs were sterile. Urotropin had been taken for some days before death. In addition to the marked chronic interstitial nephritis and small abscesses (where the polymorphonuclear neutrophilic leucocyte was the most common cell), there were a number of areas of cellular infiltration of the interstitial tissue without changes in the epithelium. The cells in these areas were plasma cells, lymphocytes, and eosinophiles. In the adventitia of one of the small arteries there were numbers of plasma cells and eosinophiles.

In the first of the three last-mentioned cases the areas of cellular infiltration probably represented simply an acute exacerbation or spreading of the chronic process. The last two cases, however, very closely resemble the very similar ones reported by Councilman on page 416 of his monograph.

Etiology of Acute Interstitial Nephritis. Consideration has already been given to the bacteriological examination of the kidneys in acute interstitial nephritis. As a result of his work Councilman concludes that bacteria play no part in the etiology of this affection, for in many cases cultures are sterile, and in the cases where organisms are found they are of various kinds, and no bacteria can be demonstrated in the hardened sections. In our three cases there was general streptococcus infection after abortion in one case; in one case there was otitis media and bronchopneumonia, due to streptococci, and in the other case no bacteria grew except a very few staphylococci from a small stitch abscess. Both Councilman and I have, however, found acute interstitial nephritis in kidneys the seat of suppurative processes, in which staphylococci, streptococci, B. coli, and B. aërogenes capsulatus were found. Councilman concluded that no adequate explanation has been offered for the focal lesions in the kidneys, but thinks that physical conditions of the circulation may be concerned in the accumulation of cells in certain places, and that the interstitial foci may be due to the presence of soluble substances exerting a positive chemotaxis for the cells.

It seems to me that the latter is the correct explanation. This process occurs especially in diseases due to or which are commonly subject to mixed infection with micro-organisms which produce powerful toxins —notably B. diphtheriæ and streptococci. It seems probable, judging from the comparatively slight changes in the renal epithelium, that the toxins in the kidneys in these cases are much diluted, and instead of producing wide-spread tissue necrosis with abscess formation, they attract to themselves and cause to multiply in the interstitial tissues and in the neighboring bloodvessels cells of the same character whose proliferation they stimulate in the hæmotopœtic organs; for, as Councilman and Pierce have shown in scarlet fever and diphtheria, great numbers of plasma cells are formed in the bone-marrow, spleen, and lymph-glands. I have observed the same thing in diphtheria.

In a large number of inflammatory and other processes, notably in infections caused by the streptococcus, the gonococcus, and the tubercle bacillus I have observed a large increase of plasma cells and eosinophiles in the lymph-glands and even the spleen. I have traced the development of plasma cells into eosinophiles with typical granulations in a variety of tissues and conditions, and have elsewhere called attention to this fact.[1] These observations will be reported in detail in another article.

CONCLUSIONS. I have been able to confirm Councilman's observation of the occurrence (1) of plasma cells, lymphocytes, polymorphonuclear leucocytes in acute interstitial nephritis. (2) The presence of lymphocytes and plasma cells in the dilated vessels. (3) Mitosis and evident amœboid activity of plasma cells in both bloodvessels and tissues.

In addition to the cells described by previous authors I find large numbers of typical eosinophilic leucocytes in the interstitial exudation and in the bloodvessels in acute interstitial nephritis. In some places in one case these were the most numerous cells in the exudation.

The eosinophilic leucocytes in the lesions of acute interstitial nephritis are for the most part brought to the part by the bloodvessels and reach the interstitial tissue by emigration, but there is evidence (in one case) that they may be formed locally from plasma cells. The large phagocytic cells were not found in my cases.

My thanks are due to Dr. R. G. Perkins for the photomicrographs and to D. W. Whitcomb for the drawings.

RARE CARDIAC ANOMALIES.

CONGENITAL AORTICO-PULMONARY COMMUNICATION; COMMUNICATION BETWEEN THE AORTA AND THE LEFT VENTRICLE UNDER A SEMILUNAR VALVE.[2]

BY LUDVIG HEKTOEN, M.D.,
OF CHICAGO.

IN the following will be described two decidedly uncommon defects —one of the septum between the pulmonary artery and the aorta, and

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[1] Philadelphia Medical Journal, December 19, 1899.

[2] Read before the Chicago Pathological Society, November 11, 1900.